King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Math 101
Final Exam
Semester I, 2003–2004 (031)
Dr. Faisal Fairag

Name: _____ ID #: _____

Section #: 11 28

Question #		Points
1		35
2		30
3		35
4-13		5 each
14-33		10 each
Total:		350

MCQ	Answer
4	
5	
6	
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11	
12	
13	

MCQ	Answer
14	
15	
16	
17	
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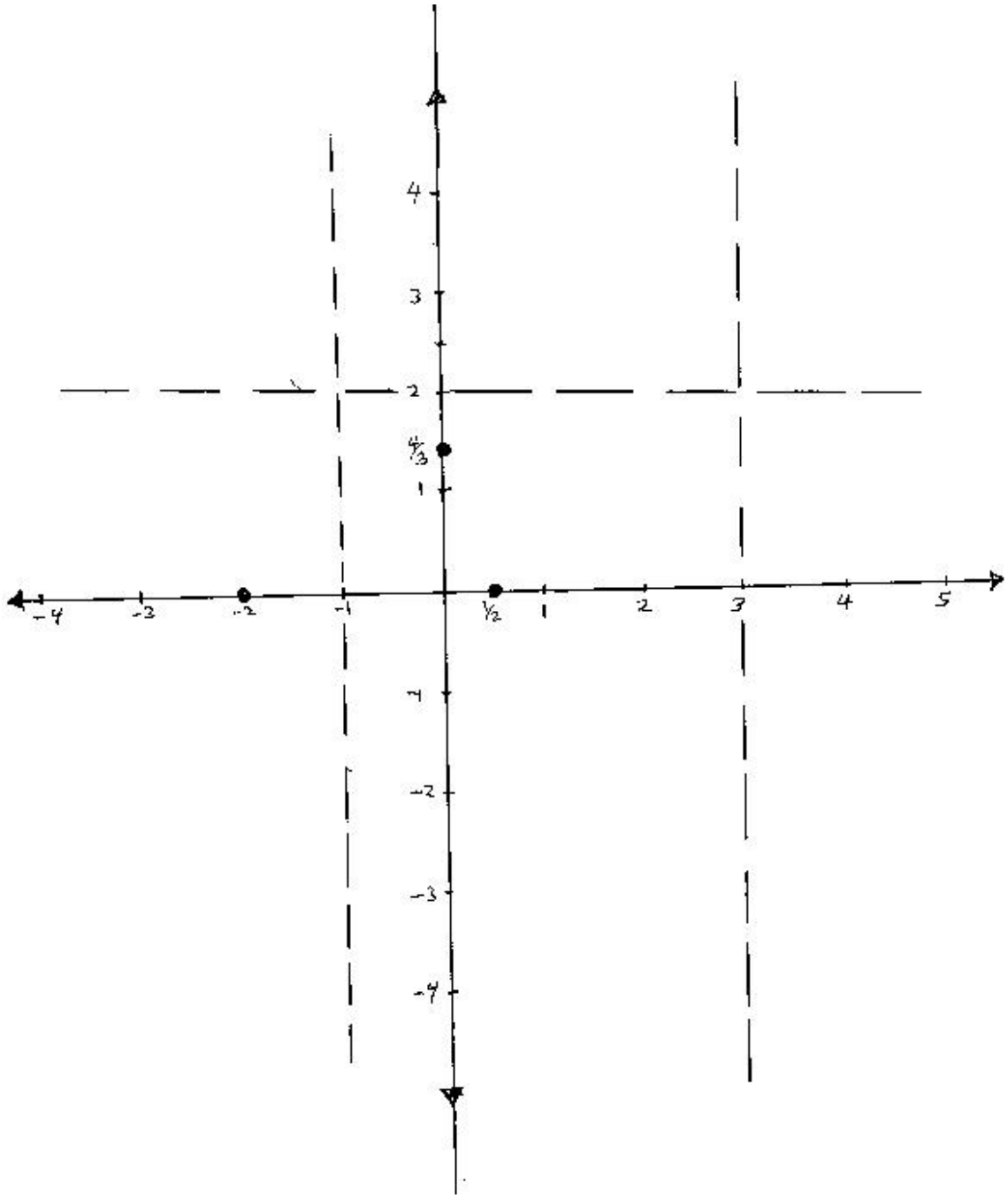
1. Use Newton's Method to approximate a solution of the equation $x^4 + x - 3 = 0$ (Use $x_1 = -1$ to find x_2, x_3, x_4, x_5, x_6).

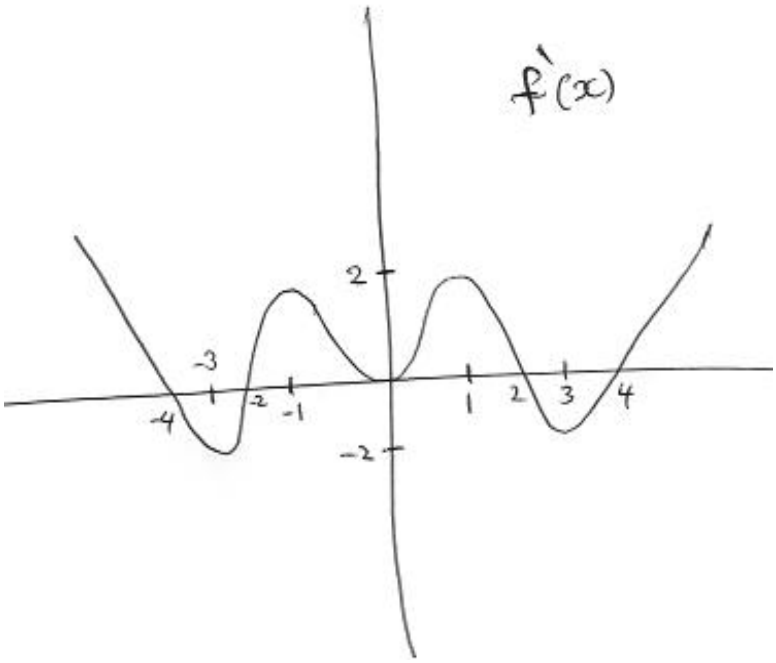
2. Find $\lim_{x \to +\infty} (\sqrt{x^2 + x} - x)$.

3. Sketch a graph of $f(x) = \dfrac{(2x-1)(x+2)^2}{(x+1)^2(x-3)}$.

Symmetries: There are no symmetries.
x-intercepts: $x = \frac{1}{2}, x = -2$.
y-intercepts: $y = \frac{4}{3}$.
Vertical asymptotes: $x = -1, x = 3$.
Horizontal asymptote: $y = 2$.



In questions 4-10, consider the adjacent graph of $f'(x)$.



4. $f(x)$ has _____ critical numbers

   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) 5

5. $f(x)$ has _____ relative extrema

   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) 5

6. $f(x)$ is increasing in the interval

   (a) $(-\infty, 0)$
   (b) $(0, 2)$
   (c) $(2, +\infty)$
   (d) $(1, 3)$
   (e) $(-\infty, +\infty)$

7. $f(x)$ is concave down in the interval

   (a) $(-\infty, -2)$
   (b) $(0, 2)$
   (c) $(2, 4)$
   (d) $(-1, 0)$
   (e) $(-\infty, +\infty)$

8. $f(x)$ has _____ inflection points

   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) 5

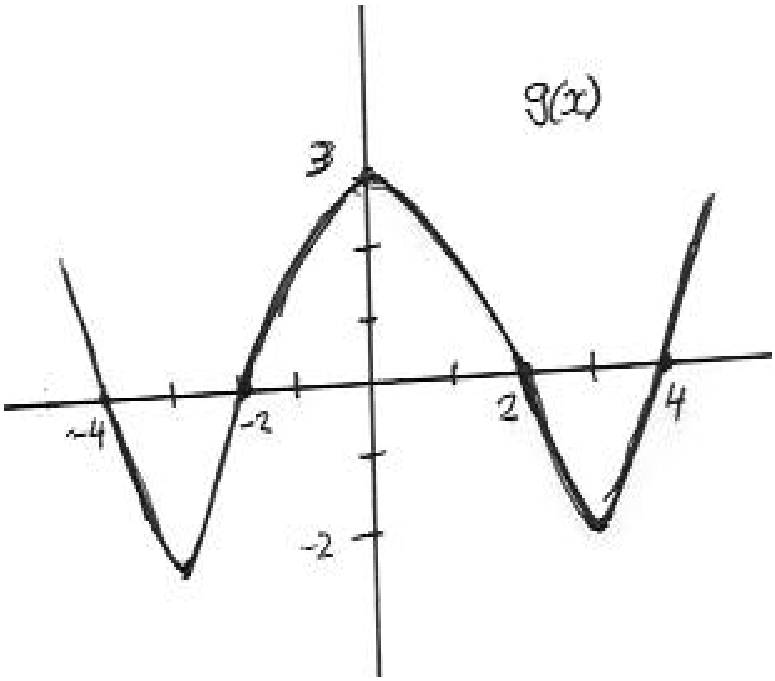
9. $f(x)$ has _____ stationary points

   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) 5

10. $f(x)$ has absolute minimum

    (a) True
    (b) False

In questions 11-13, consider the adjacent graph of $g(x)$.



11. $\lim_{x \to 0^+} g(x) =$

    (a) $+\infty$
    (b) 0
    (c) 1
    (d) 2
    (e) 3

12. $\lim_{x \to +\infty} g(x) =$

    (a) $-\infty$
    (b) 0
    (c) 4
    (d) $+\infty$
    (e) 1

13. $\lim_{h \to 0} \dfrac{g(3+h) - g(3)}{h}$

    (a) 0
    (b) 1
    (c) $\dfrac{3+h}{h}$
    (d) $\dfrac{h-3}{h}$

In questions 14-17, consider the function $f(x) = x^3 - 3x^2$.

14. $f(x)$ is concave up on

    (a) $(1, +\infty)$
    (b) $(-\infty, 1)$
    (c) $(-3, 3)$
    (d) $(0, +\infty)$

15. $f(x)$ has inflection point at $x =$

    (a) 1
    (b) 2
    (c) 3
    (d) 4

16. $f(x)$ has relative maximum at $x =$

    (a) 0
    (b) 1
    (c) 2
    (d) 3

17. $f(x)$ has relative minimum at $x =$

    (a) 0
    (b) 1
    (c) 2
    (d) 3

18. $f(x) = x^2 - 4x + 3$ is increasing on

    (a) $(-\infty, 2)$
    (b) $(2, +\infty)$
    (c) $(0, 10)$
    (d) $(0, +\infty)$

19. $f(x) = x^2 - 4x + 5$ has absolute maximum on the on the interval $[0, 3]$ at $x =$

    (a) 0
    (b) 1
    (c) 2
    (d) 3

20. The function $f(x) = x^{1/3} + (x-3)^{-1}$ satisfies the hypotheses of the mean value theorem on the interval

    (a) $[2, 4]$
    (b) $[-1, 1]$
    (c) $[1, 2]$
    (d) $[-1, 4]$

21. The value of c in the interval $[1, 2]$ that satisfies the condition of the Mean Value Theorem is (where $f(x) = x^2 - 1$)

    (a) $5/3$
    (b) 3
    (c) $3/2$
    (d) $5/4$

22. $\lim_{x \to 0^+} \left(\ln x - \frac{1}{x} \right)$

    (a) $+\infty$
    (b) $-\infty$
    (c) e^{-2}
    (d) $-1/2$

23. $\lim_{x \to +\infty} (2xe^{-x})$

    (a) 2
    (b) $+\infty$
    (c) 0
    (d) e^2

24. If $f(x) = tan^{-1}(x^4)$ then $f''(1) =$

    (a) $-\frac{1}{4}$
    (b) $-\frac{1}{2}$
    (c) 0
    (d) $\frac{1}{2}$
    (e) $\frac{1}{4}$

25. Use local linear approximation to approximate $(1.001)^{37} \approx$

    (a) 1.0376
    (b) 1.03767
    (c) 1.037
    (d) 1.038
    (e) 1.036

26. Use local linear approximation to approximate $\frac{1}{\sqrt{3.9}} \approx$

    (a) 0.50637
    (b) 0.5125
    (c) 0.51256
    (d) 0.4875
    (e) 0.5063

27. A spherical balloon is inflated so that its radius is increasing at the rate of 0.5 m/min. How fast is the volume of the balloon increasing when the radius is 2 m?
    (Hint: volume of sphere $= \frac{4}{3}\pi r^3$).

    (a) $8\pi \quad m^3/min$
    (b) $8 \quad m^3/min$
    (c) $16\pi \quad m^3/min$
    (d) $16 \quad m^3/min$
    (e) $\frac{32}{3}\pi \quad m^3/min$

28. The slope of the curve $y = sec^2 x$ at $x = 0$ equals

    (a) -1
    (b) 0
    (c) 1
    (d) $+\infty$
    (e) $-\infty$

29. If $\lim_{x\to 3} f(x)$ does not exist, then f is discontinuous at $x = 3$

    (a) True

    (b) False

30. A rational function is continuous at every number where the dominator is nonzero

    (a) True

    (b) False

31. Find the x-coordinate of the point at the graph of $y = x^4 + 2x^2$ where the tangent line is horizontal.

    (a) -1

    (b) 0

    (c) 1

    (d) 2

    (e) 3

32. If $f(x) = \frac{lnx}{1+lnx}$, then $f'(1) =$

    (a) 0

    (b) 1

    (c) e

    (d) $-e$

    (e) -1

33. If $f(x) = \frac{e^{3x}}{1+e^{-2x}}$, then $f'(0) =$

    (a) $\frac{1}{2}$

    (b) $\frac{1}{1+e}$

    (c) 2

    (d) $\frac{3e}{1+e}$

    (e) 0